UNIVERSITY OF CALGARY

THE SCHOOL OF PUBLIC POLICY PUBLICATIONS

SPP Technical Paper

Volume 12:29 September 2019

THE EFFECT OF CORPORATE INCOME TAX ON THE ECONOMIC GROWTH RATES OF THE CANADIAN PROVINCES

Ergete Ferede and Bev Dahlby

SUMMARY

This paper provides an empirical estimation of the effects of provincial corporate tax rates on economic growth using annual panel data from Canadian provinces over the period 1981-2016. Our empirical approach enables us to investigate the long-run relationship between provincial tax rates and economic growth by allowing short-run dynamics to vary across provinces. We find that a reduction in the provincial CIT rate has a statistically significant positive effect on economic growth rate. Based on our preferred specification of the econometric model, a one percentage-point reduction in a provincial government's statutory CIT rate increases the growth rate by 0.12 percentage points four years after the initial CIT rate cut and increases real per capita GDP by 1.2 per cent in the long run. The results are robust to various sensitivity checks. These results are consistent with the empirical estimates in our previous study of Ferede and Dahlby (2012), who used a different econometric methodology and sample period. They are also broadly consistent with the findings of recent empirical studies of the impact of corporate income taxes on the economic performance of U.S. states. In a companion communiqué, we use the econometric results to estimate the increase in Alberta's growth rate from the Alberta government's announced reduction in the provincial CIT rate from 12 per cent in 2018 to eight per cent in 2022.

http://dx.doi.org/10.11575/sppp.v12i0.68314 www.policyschool.ca

1. INTRODUCTION

In this paper, we investigate the effects of corporate income tax rates on economic growth rate using annual panel data for Canadian provinces over the period 1981-2016. Our empirical approach enables us to investigate the long-run relationship between provincial tax rates and economic growth by allowing short-run dynamics to vary across provinces. That is, as the provinces in the same federation are highly interconnected and influenced by many similar factors, they are expected to have the same long-run equilibrium. However, due to variations in the structure of their economies, they may tend to reach the common long-run equilibrium at their own respective convergence rates. Our empirical results obtained from a pooled mean group (PMG) estimator show that the corporate income tax (CIT) rate has a statistically significant negative effect on economic growth. In the neo-classical growth model-based studies such as ours, this growth effect is "temporary" as the growth rate eventually returns to its long-run equilibrium growth rate. According to our preferred specification of the econometric model, a one-percentage-point reduction in a provincial government's statutory CIT rate increases the growth rate by 0.12 percentage points four years after the initial CIT rate cut and increases real per capita GDP by 1.2 per cent in the long run. The result is broadly consistent with the findings of recent empirical studies of the impact of corporate income taxes on the economic performance of U.S. states and is robust to various sensitivity checks. In a companion communiqué, we use the econometric results to estimate the increase in Alberta's growth rate from the Alberta government's announced reduction in the provincial CIT rate from 12 per cent in 2018 to eight per cent in 2022.

The remaining part of the paper is organized as follows. Section 2 contains a selective review of recent studies of the effects of corporate taxes on the economic performance of U.S. states and Canadian provinces. Section 3 provides an overview of the Canadian corporate income tax system to highlight the differences between the tax systems of the Canadian provinces and the U.S. states and to put our econometric results in perspective. Section 4 contains our main empirical results and robustness checks. Section 5 concludes.

2. A SELECTIVE REVIEW OF THE LITERATURE ON THE EFFECTS OF TAXES ON ECONOMIC PERFORMANCE OF U.S. STATES AND CANADIAN PROVINCES

A large body of empirical studies has investigated the effects of taxes on key economic variables, including employment, investment, entrepreneurship and economic growth. Related to our study in terms of methodology and topic are the papers that have used international panel data such as Koester and Kormendi (1989), Kneller, Bleaney and Gemmell (1999), Bleaney, Gemmell and Kneller (2001), Lee and Gordon (2005) and Djankov et al. (2010). See McBride (2012), Mazerov (2013) and Huang and Frentz (2014), who survey the literature and come to different conclusions regarding whether or not it generally supports the hypothesis that taxes harm economic growth.[1]

[1] See the online Appendix for a summary of studies of taxation and economic performance since Ferede and Dahlby (2012). https://www.policyschool.ca/publication-category/research-data/.

2.1 TAXATION AND THE ECONOMIC PERFORMANCE OF THE U.S. STATES

For putting our study into context, the empirical literature on the effects of taxation on the economic performance of the U.S. states is particularly relevant for current study. Here we will review five key studies produced since 2012.

Gale, Krupkin and Reuben (2015) examined the robustness of the Reed (2008) results which had indicated that taxes negatively affected the growth rate of real per capita income in the U.S. states. They replicated the Reed model for the 1970-1999 period and then re-estimated it with data extended to 2006 or 2011. Gale et al. found that personal and corporate income taxes had positive effects on growth with the extended data set and concluded that Reed's results were not sensitive to the time period used to estimate the effects of taxes on growth.[2] They also found that the top marginal personal income tax rate did not affect the employment growth rate but had a small negative impact on the rate of firm formation. A surprising finding in the Gale et al. study was that property taxes had a consistently negative impact on growth, a result that challenges the widely prevailing view, as expressed by Johansson et al. (2008), that property taxes are among the least damaging taxes.

The standard theoretical model of corporate taxation in small open economies predicts that the tax burden will be shifted to labour and land, which are less mobile than capital. Suárez Serrato and Zidar (2016) developed a theoretical model with imperfectly mobile labour and monopolistically competitive firms that can earn profits because of location-specific differences in productivity. They estimate a reduced-form version of the model based on 490 county-groups data for 1980 to 2012 to determine the effect of state personal income tax rates and state corporate income tax rates adjusted for weights in the apportionment formula. Suárez Serrato and Zidar (2016) concluded that firms' owners bear about 40 per cent of the burden of state corporate income taxes, while workers bear 30 to 35 per cent through lower real wages, and landowners bear 30 to 35 per cent. It should be noted, however, the standard error of the landowners' share is very large, and the point estimates are generally not significantly different from zero, which would imply that firms' and workers' shares of the burden also have large confidence intervals. See Suárez Serrato and Zidar (2016, Table 5 column 6). Furthermore, the majority of workers are homeowners and would also bear the landowners' share of the tax burden.[3] They also find that a tax rate that maximizes total state tax revenues is close to the actual average statutory rate of 6.6 per cent. The relatively low CIT rate that maximizes total state tax revenues implies that at the margin, CIT rates have a large negative impact on a state's economic performance.

Ljungqvist and Smolyansky (2018) estimated the economic effects of state corporate income tax rates based on data on 943 contiguous counties straddling state borders over the period 1970 to 2010. They found that a one-percentage-point increase in the corporate tax rate reduced employment in the affected county by 0.2 per cent and reduced total wage income by about 0.3 per cent compared to the county in the adjoining state. On the

---

[2] The Gale et al. results are one of the reasons we have prepared this study, which is based on longer and more recent data than were used in Ferede and Dahlby (2012).

[3] Data from Lattice Publishing (2018) indicate that homeownership rates in 2018 vary from 75.8 per cent in West Virginia to 50.9 per cent in New York. Only in the District of Columbia is the homeownership rate below 50 per cent.

other hand, tax cuts did not affect employment or wages except when implemented during a recession, in which case there were sizable positive responses in both employment and wage income.

Giroud and Rauh (2019) used a sample of over 27 million establishments between 1977 and 2011 in firms with at least 100 employees and permanent establishments in more than one state to estimate the impact of state taxation on business activity. They found that a one-percentage-point increase in a state corporate tax rate, weighted by the components of the state's allocation formula, reduced the average number of C corporation establishments by 0.4 per cent. The elasticity of employment in existing establishments with respect to the corporate tax rates was -0.4. State corporate taxes also had negative effects on capital formation, but the elasticities were 36 per cent lower. Giroud and Rauh (2019, 24) also found that "changes in the tax rates of other states where the parent firm has establishments … have about half the effect as the tax rates of the state of the establishment itself." They also found that corporate taxes in states that only allocate taxable income on the basis of sales had significantly lower effects than those with a 33-per-cent weight on sales. Unemployment insurance premiums and property tax share of total state and local revenues had a negative impact on the number of establishments while the personal income tax rate and sales taxes did not affect C corporation establishments, but reduced the probability of an S corporation (a pass-through entity) establishment in a state.

Fajgelbaum et al. (2019) developed a spatial general equilibrium model of the U.S. states' tax systems and estimated key parameters from 350 state personal income, sales and corporate income tax rate changes between 1980 and 2010. The paper's main conclusion was that the dispersion of state tax rates reduces aggregate welfare in the U.S. Eliminating the dispersion of tax rates would increase aggregate welfare by 0.6 per cent, holding government spending constant, and by 1.2 per cent with endogenous changes to government spending. Fajgelbaum et al. (2019, Table 7) also use the model to evaluate the overall effects of tax changes between 1980 and 2007, which saw an increase in the states' reliance on sales-apportioned corporate taxes and a reduction in reliance on state personal income taxes. The result of this shift to more consumption-related taxation was a welfare increase of 0.97 per cent, holding government spending constant, and a 3.15-per-cent increase in welfare with endogenous changes in government spending. Most of the welfare improvements accrued to workers and were due to the increased reliance on sales taxation. The increased reliance on sales-apportioned corporate taxes had an ambiguous impact on welfare, with a 0.06-per-cent decline holding government spending constant and a 0.66-per-cent increase with endogenous government spending responses.

This selective review of these recent detailed, high-quality studies indicates that state taxes, and corporate income taxes in particular, have a major impact on growth, employment and workers' well-being.

2.2 TAXATION AND THE ECONOMIC PERFORMANCE OF THE CANADIAN PROVINCES

The literature on the effects of taxes on the economic performance of the Canadian provinces is very meagre – consisting, as far as we are aware, of only two papers that are reviewed below. However, in Section 3 we also review several papers about the broader economic impacts of provincial corporate income taxes.

Beaulieu, McKenzie and Wen (2006) analyzed the effects of taxes on the number of establishments in 18 manufacturing industries in six provinces over 28 years. They found that the elasticity of the number of establishments with respect to the effective tax rate on the marginal cost of production was -0.3. Taxes on labour income had a significant negative effect on the number of manufacturing establishments while the marginal effective tax rate on machinery and equipment was not significant. Government spending on transportation infrastructure had a positive effect.

Ferede and Dahlby (2012) studied the impact of provincial CIT rates on the investment and growth rates of the Canadian provinces using panel data over the period 1977 to 2006. Their study indicated that a one-percentage-point reduction in the corporate marginal tax rate is associated with a 0.34-percentage-point increase in the private investment to GDP ratio, an impact that is generally consistent with the results that Parsons (2008) found with industry-level data for Canada.[4] The Ferede and Dahlby econometric models also indicated that a higher provincial CIT rate reduces economic growth by reducing productivity and by lowering investment and that a one-percentage-point increase in the corporate tax rate is associated with a 0.1- to 0.2-percentage-point reduction in a province's annual growth rate. These growth effects from a CIT tax rate increase are "temporary" because in their model, in the long run the growth rate returns to its steady state rate based on an exogenous rate of technological change and productivity growth. However, the growth rate effects of a CIT rate change persist for a long time and have a substantial effect on a province's long-run output.

3. AN OVERVIEW OF CANADIAN PROVINCIAL CORPORATE INCOME TAXES

A distinctive feature of Canadian fiscal federalism is the substantial amount of tax revenue that provincial and local governments raise. The provinces levy all of the major taxes, except customs duties. They levy property taxes and collect royalties on natural resources, sources of revenue that are not tapped by the federal government. Among countries around the world, only Switzerland – where the cantons and communes raised 39.6 per cent of total tax revenues – and the United States – where state and local governments raised 33.0 per cent – come close to rivalling the 49.9 per cent of total tax revenues raised

[4] Parsons (2008) used the seven-percentage-point reduction in the federal corporate tax over the 2001 to 2004 period, which did not apply to manufacturing industries, to create "treatment" and "control" groups and to identify the effect of lower taxes on business investment. He found that a10-per-cent reduction in the tax component of the user cost of capital increased the capital stock by three to seven per cent.

by Canadian provincial and local governments in 2015.[5] From a taxation perspective, Canada is the most decentralized country in the world.

In particular, the provincial governments are major players in the corporate income tax field. Figure 1 shows that the Canadian provinces' share of corporate income tax revenues has increased from 23.0 per cent in 1965 to 38.7 per cent in 2017, whereas in the United States the states' and local governments' share of CIT revenues has declined from 27.6 per cent in 1983 to 14.6 per cent in 2017. According to Ljungqvist and Smolyansky (2018), corporate income taxes represented around five per cent of U.S. state government revenues in 2010. In Canada, corporate tax revenues averaged 7.0 per cent of provincial government revenues from 2008 to 2017.[6] However, reliance on corporate tax revenues varied greatly, from three per cent of revenues in Prince Edward Island to 10 per cent in Alberta.

Also, in contrast to other federal countries such as Germany, the provinces have complete autonomy in setting corporate tax rates. Even though the federal Canada Revenue Agency (CRA) administers the collection of corporate income taxes for eight of the 10 provinces, provinces have substantial control in defining the CIT base, within limits determined by their tax collection agreements with the federal government. While Alberta and Quebec administer their own CITs, their tax bases generally parallel the federal and other provinces' tax bases to reduce businesses' tax compliance costs. As a result, the provincial corporate income tax systems display a greater degree of harmonization than among the OECD countries or U.S. states.

One notable example of the greater degree of sub-national tax harmonization in Canada is the use of a common allocation formula for taxable income, based on equal weights for shares of sales and payrolls generated by businesses with permanent establishments in more than one province.[7] This contrasts with the situation in the U.S. Traditionally, states used three equally weighted factors – the shares of sales, payrolls and property of a corporation in a state – to determine the corporate tax liability in a state. However, since 1986, many states have started to "double weight" the sales factor and thereby reduce the weights on payroll and property in an attempt to attract employment and investment. Now, 30 per cent of states only use the share of sales in a state to determine the tax liability of a corporation with operations in more than one state.[8] Suárez Serrato and Zindar (2018, 159) argue that these changes to the allocation formulas and other measures that have narrowed the states' tax bases mean that "a tax rate increase mechanically raises less revenue since taxable income is a smaller portion of overall income. In addition, tax changes have smaller incentive effects, so the behavioral responses to tax rate increases are likely attenuated." Changes in the states' allocation formulas over time and differences across states in the allocation formula and other policies that determine taxable income

---

5 Based on the OECD Fiscal Decentralization Data Base. Available at http://www.oecd.org/ctp/federalism/fiscal-decentralisation-database.htm#C_5

6 In Canada, corporate tax revenues averaged 7.0 per cent of provincial government revenues from 2008 to 2017, according to Statistics Canada.

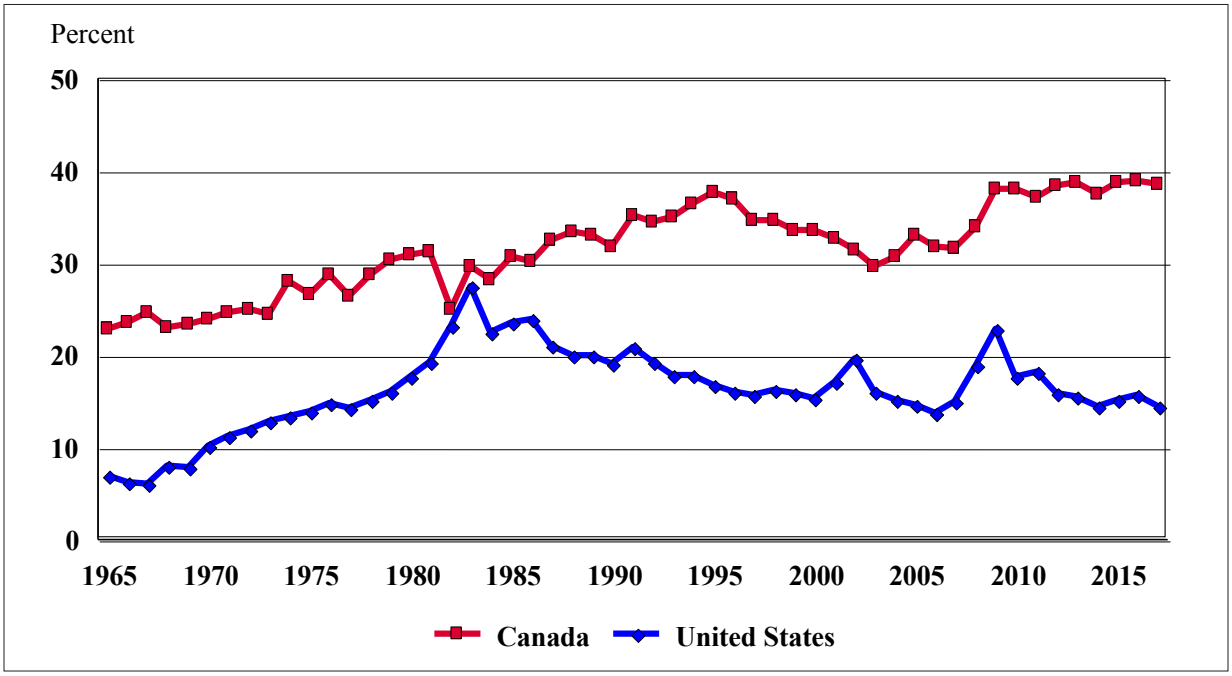
7 Special allocation rules apply to the finance and transportation sectors. In the 2011 to 2015 period, 40 per cent of federal taxable income was allocated among the provinces.

8 Clausing (2014, 8).

makes it difficult to estimate the effects of corporate income tax rate changes on the U.S. states' economic performance in panel regression models that do not take these factors into account. While there are variations in the provincial corporate tax bases and available tax credits across provinces and over time, observers familiar with the tax system on both sides of the Canada/U.S. border generally agree that there is a greater degree of tax base harmonization in Canada.

Two other important fiscal differences between the U.S. states and the Canadian provinces should be noted. First, provincial personal and corporate income taxes are not deductible from Canadian federal taxes whereas state and local taxes are eligible for federal deductions in the U.S. This means that a provincial corporate income tax increase has a larger impact on incentives to invest than a similar state corporate income tax increase. A second important difference between Canadian provinces and U.S. states is that the provinces either do not have balanced-budget laws or their balanced-budget laws have not effectively constrained their ability to run deficits, whereas many U.S. states are required to run balanced budgets. As Gale, Krupkin and Reuben (2015, 920) point out, "state balance budget requirements imply that revenues and spending should co-vary closely, making it more difficult to study independent influences of taxes or spending." Using Musgrave's distinction between absolute, differential and balanced budget fiscal adjustments, our empirical results in Section 5 can be interpreted as an absolute fiscal adjustment where the government's surplus or deficit adjusts in response to a change in the corporate tax rate, whereas in the U.S. context the fiscal adjustment is more likely to be an offsetting change in another tax or expenditures.

FIGURE 1 SUB-NATIONAL CIT REVENUES AS A PERCENTAGE OF TOTAL CIT REVENUES IN CANADA AND THE U.S. 1965 TO 2017



Source: OECD Tax Revenue Data Base

3.1 TRENDS IN PROVINCIAL CORPORATE TAX RATES

One reason why provincial shares of CIT revenue shares have increased is that the federal statutory CIT rate has declined since the 1970s, whereas the weighted average general provincial statutory CIT rate has remained relatively constant. Figure 2 shows that the weighted average provincial CIT rate, based on the provinces' shares of CIT revenues from 2008 to 2014, increased from 11.9 per cent in 1972 to 14.4 per cent in 1994 before gradually declining to 11.8 per cent in 2016. On the other hand, the general federal CIT rate ranged between 36.5 per cent and 40.5 per cent from 1974 to 1988, before declining to around 29 per cent in the 1990s. Starting in 2000, the federal CIT rate steadily declined to 15 per cent in 2012. What these trends indicate is that the average provincial CIT rate has increased relative to the federal CIT rate –from 32.6 per cent in 1972 to 78.8 per cent in 2016 – and this can account for much of the increase in the provincial share of CIT revenues.

FIGURE 2 TRENDS IN FEDERAL AND THE WEIGHTED AVERAGE PROVINCIAL GENERAL STATUTORY CIT RATES

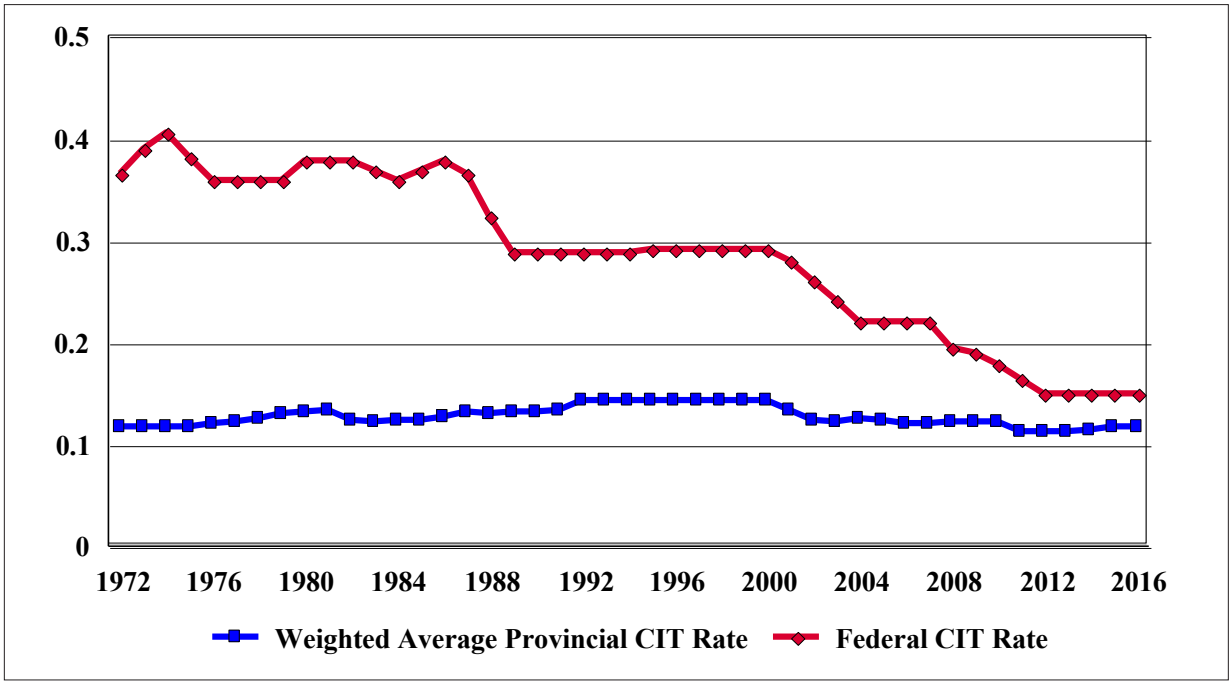


FIGURE 3A STATUTORY GENERAL CIT RATES IN THE ATLANTIC PROVINCES, 1981 TO 2016

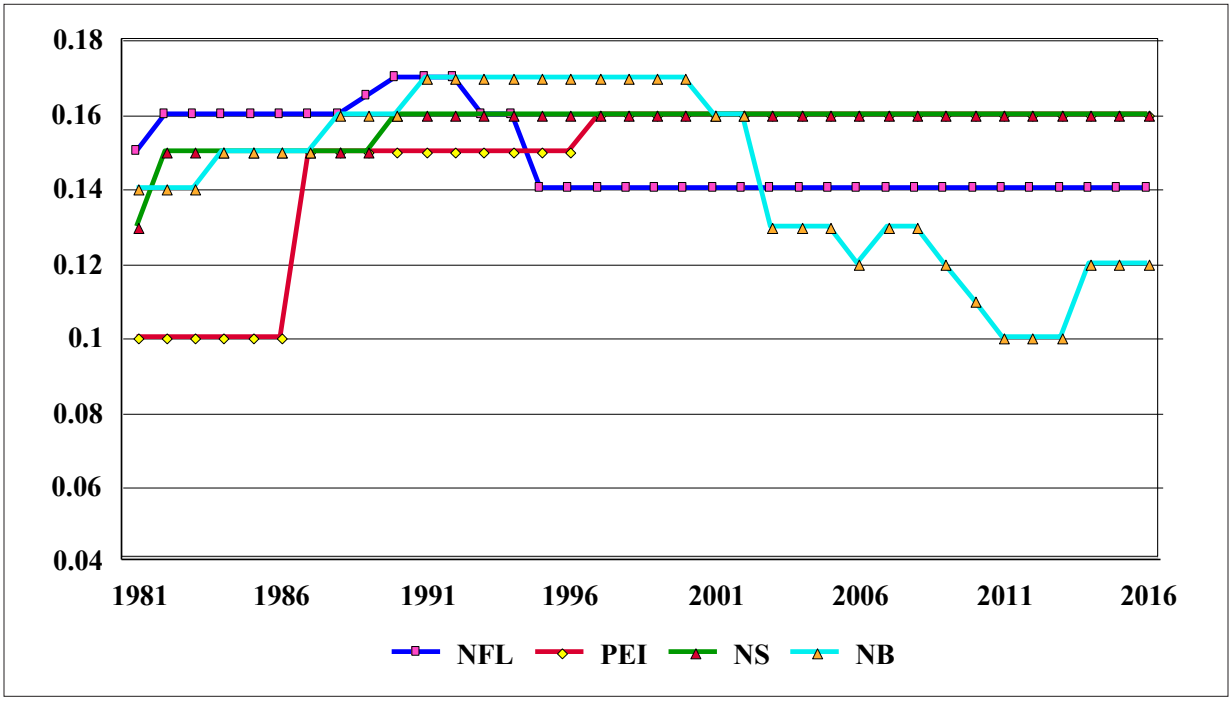


FIGURE 3B STATUTORY GENERAL CIT RATES IN THE OTHER PROVINCES, 1981 TO 2016

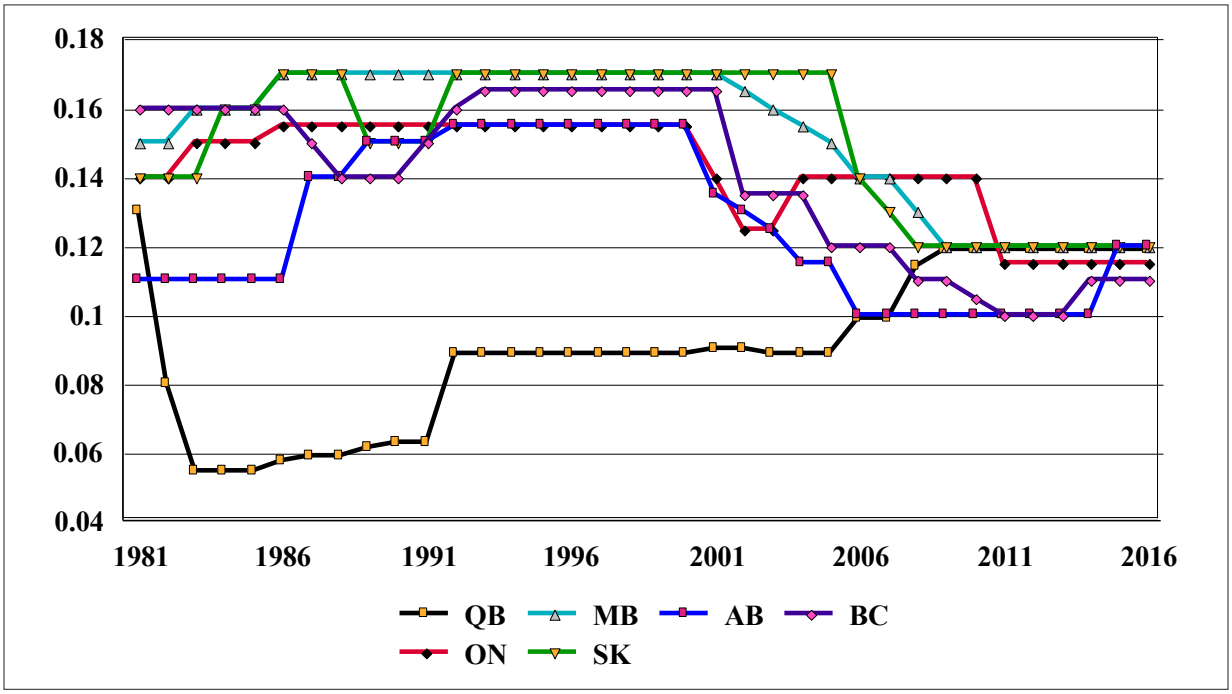


Figure 3a shows the trend in the general statutory tax rates of the four Atlantic Provinces and Figure 3b shows the rates for the other six provinces from 1981 to 2016.[9] (We show the CIT rates for these two groups separately for visual clarity and because the Atlantic Provinces have smaller populations and have had poorer economic performance than the other six provinces). Note that with the exception of New Brunswick, the CIT rates of the other three Atlantic Provinces have generally been higher and more stable than in the other six provinces. Turning to Figure 3b, we see that Quebec sharply reduced its CIT rate in 1982 from eight to 5.5 per cent and maintained a rate that was lower than in any other province until 2006. In contrast, the other provinces increased their CIT rates in unsynchronized steps from 1981 to 1992. Over this period, the median provincial CIT rate increased from 12 per cent to 16 per cent. From 1992 to 2000, the nine provinces maintained their CIT rates in a relatively narrow band, from 14 to 16 per cent. Starting in 2001, with cuts in Alberta and Ontario, the CIT rates started to decline in the other provinces, except in Nova Scotia and P.E.I., which maintained their 16 per cent tax rates. On the other hand, Quebec started to increase its CIT rate. Over this period, from 2001 to 2016, the median provincial CIT rate declined from 16 per cent to 12 per cent in 2016, and the CIT rate differential among the six provinces shown in Figure 3b has shrunk.

Given the large differences in the sizes and performances of the provincial economies, it should not be surprising that there are large variations in provincial CIT revenues. Four provinces – Ontario (35.4 per cent), Quebec (21.3 per cent), Alberta (20.0 per cent) and British Columbia (10.7 per cent) – accounted for 87.4 per cent of provincial CIT revenues from 2008 to 2014.[10]

3.2 DETERMINANTS OF PROVINCIAL CORPORATE INCOME TAX RATES

Figures 3a and 3b indicate the provinces' statutory corporate tax rates are "sticky", i.e., the provinces tend to maintain the same tax rate for long periods rather than adjusting them from year to year. A study of the timing and direction of provincial tax changes between 1973 and 2010 by Ferede et al. (2015) found that there were only 83 statutory corporate income tax rate changes out of a possible 380 province-year episodes. In other words, 78 per cent of the time there were no provincial corporate income tax rate changes. Provincial personal income tax changes were more frequent and sales tax changes were less frequent than corporate income tax changes. Ferede et al. (2015) used a multinomial logit model to investigate the factors that triggered provincial tax rate changes over the period 1973-2010. Their statistical results indicated that provincial governments that start with higher tax rates are more likely to cut, and less likely to raise, their tax rates. They also found that politics matters – left-leaning parties in power and minority governments are more likely to raise the CIT rate. However, the number of years remaining in a provincial government's term in office did not seem to influence the timing of CIT rate changes. Fiscal pressures also matter. Provincial governments with a higher deficit to GDP ratio are more likely to raise the CIT rate rather than leave it unchanged, while an increase in real per capita federal grants reduces the probability of a CIT rate increase. They also found that provincial governments

---

9 The provinces also set lower tax rates for small businesses and in some cases for manufacturing and processing activities, but these are excluded from this analysis.

10 Calculations based on Statistics Canada, CANSIM Table 385-0034.

tended to raise personal income tax and corporate income tax rates at the same time, while a personal income tax (PIT) rate reduction was generally not co-ordinated with a corporate income tax (CIT) rate cut. Ferede et al. (2015) also found that a cut in the federal CIT rate increases the likelihood of a provincial CIT rate cut by a factor of four, indicating the federal and provincial CIT rates tend to move in the same direction when rates are coming down. They also found that when the average CIT rate in other provinces is higher, the likelihood of a CIT rate increase in a province is higher, but that changes in other provinces' CIT rates in a given year do not affect the timing of a tax rate change in a province.

Hayashi and Boadway (2001) and Karkalakos and Kotsogiannis (2007) have also studied the degree of corporate tax competition among the Canadian provinces and their responses to federal corporate tax rate changes. These studies differ from the Ferede et al. (2015) study because the dependent variable in their econometric models is the average effective tax, measured as the ratio of corporate taxes to total corporate profits. One limitation of using average effective CIT rate is that this variable is not completely under the control of a provincial government because the denominator is affected by current economic conditions.

Hayashi and Boadway (2001) estimated a model of the interdependence of the Ontario, Quebec and federal average effective tax rates as well as the average tax rate of the other eight provinces using annual data for the period 1963 to 1996. They found that in general, there was a tendency for provincial average effective tax rates to be positively related to the rates in other provinces. Ontario's average effective rate has a strong impact on the federal and Quebec's average effective rate, but was not significantly affected by the rates in other provinces. They also found that higher federal rates reduced CIT rates in Quebec and other provinces, but not in Ontario.

Karkalakos and Kotsogiannis (2007) estimated their model, which emphasized the spatial dimension of tax competition, using annual data from 1961 to 1996, for all 10 provinces and the federal government. They found that the average effective CIT rates in neighbouring provinces had a positive effect on a province's CIT rate, that Ontario's and Quebec's CIT rates are highly interdependent, that a higher federal CIT rate reduces provincial CIT rates, and that federal transfers, including equalization entitlements, have a negative effect on provincial CIT rates.

Although the focus of the above research has been on statutory or average effective CIT rates, the most intensive forms of tax competition among the provinces may be in the form of tax incentives for research and development, and television and film production, or on royalties for oil and gas production. See Crisan and McKenzie (2017) on provincial R&D tax incentives from 1981 to 2016. In all the above cases, international tax competition, especially with the U.S., particularly for Ontario, Quebec and British Columbia, may be as important as interprovincial tax competition.

3.3 THE INCIDENCE OF THE PROVINCIAL CORPORATE INCOME TAXES

As noted in Section 2.1, Suárez Serrato and Zidar (2016) found that firms' owners bear about 40 per cent of the burden of state corporate income taxes while workers bear 30 to 35 per cent through lower real wages and landowners bear 30 to 35 per cent, although

there are important caveats concerning those results. A recent study by McKenzie and Ferede (2017) has investigated the degree to which Canadian provincial corporate income taxes are shifted to workers. They used a two-part procedure to estimate the degree of tax shifting. First, they estimated the relationship between an increase in the provincial CIT rate and the capital-labour ratio in the province in the long run. Then, they estimated the relationship between the capital-labour ratio and the real hourly wage rate in the province. In the final step, they combined these two estimates to calculate the reduction in wage income from an increase in a provincial CIT rate. They found that a one-per-cent increase in a provincial government's CIT rate is associated with a long-run reduction in the capital-labour ratio of about 0.23 per cent and that a one-per-cent reduction in the capital-labour ratio is associated with a reduction in real hourly wages of about 0.46 per cent. Combining these effects, they conclude that a one-per-cent increase in the CIT rate is associated with a 0.10-per-cent reduction in the real wage rate in the long run. More concretely, McKenzie and Ferede concluded that aggregate wages decline by 95 cents for every $1 increase in CIT revenue in Alberta.

The McKenzie and Ferede econometric results are consistent with the findings of another recent Canadian econometric study by Ebrahimi and Vaillancourt (2016), which found that a one-percentage-point reduction in the provincial CIT rate increases the average hourly wage rate by 0.55 per cent to 0.88 per cent.

The high degree of shifting of the CIT burden to labour may be due to the weight placed on payrolls in the tax base allocation formula in Canada. McLure (1980, 1981) and Dahlby (2000) show that the allocation formula converts the CIT into a payroll tax on labour in a province with an above average CIT rate and a payroll subsidy in a province with a below average CIT rate. If the provinces in which a business has permanent establishments have different tax rates, expanding employment in a province with a low tax rate will lower the firm's average tax rate and lower its overall tax burden, effectively lowering the cost of hiring labour in the low-tax province. On the other hand, increasing employment in a high-tax rate province increases the firm's average tax rate on its corporate profits, increasing the cost of hiring labour in that province. The impact of the allocation formula on the marginal cost of hiring labour is greater the larger the tax rate differential between the provinces and the larger ratios of taxable profits to total payroll and to total sales.

3.4 THE DISTORTIONARY EFFECTS OF PROVINCIAL CORPORATE INCOME TAXES

Tax bases almost always shrink in response to a tax rate increase because taxpayers have an increased incentive to alter their labour, savings and investment decisions. The shrinkage of the tax base is a measure of the harmful distortion in the allocation of resources caused by taxation. Dahlby and Ferede (2012, 2018) have estimated the tax sensitivity of Canadian provinces' corporate income tax, personal income tax and provincial sales tax. Their results indicated that the corporate income tax base is more responsive to its tax rate than the personal income tax base or the sales tax base and that the tax sensitivity of the tax bases is generally higher in the smaller provinces. They also found that the responsiveness of Quebec's corporate tax base (as well as its personal income tax base) to tax rate changes is

relatively low, perhaps because of the province's linguistic and cultural uniqueness.[11] Based on their econometric results, a one-percentage-point increase in the provincial CIT rate reduces New Brunswick's CIT base in the long run by 17.6 per cent, whereas Quebec's CIT base "only" declines by 6.08 per cent.

Based on these estimates of the long-run semi-elasticities of the tax bases, Dahlby and Ferede (2018) calculated the marginal cost of public funds (MCF) for the three main provincial taxes. The MCF is a measure of the loss that a society incurs in raising an additional dollar of tax revenue.[12] The MCF will generally be higher the higher the tax rate, the more responsive the tax base is to a tax rate increase, and the extent of the contraction (or expansion) in other tax bases from the tax rate increase. Table 1 shows their estimates of the MCFs for corporate income taxes, personal income taxes and provincial sales taxes in 2018. Perhaps the most striking results from these calculations are that they indicate that six provinces are on the "wrong" side of their Laffer curves with respect to their corporate income taxes. That is, a reduction in the provincial corporate income tax rate would increase total tax revenues in the long run and therefore the MCFs are not defined in these cases. Why might so many provinces have corporate income tax rates that are "too high"? It is interesting to note that it is the small provinces that appear to be on the wrong side of their Laffer curves. Our research indicates that these provinces tend to have more tax-sensitive CIT bases than the larger provinces. In addition, four of the provinces –Prince Edward Island, Nova Scotia, New Brunswick and Manitoba – have always been recipients of federal equalization grants.[13] Smart (1998), Dahlby (2002) and Dahlby and Warren (2003) have shown that the federal equalization grant formula creates an incentive for a recipient province to impose higher tax rates and to reduce spending on productivity-enhancing infrastructure. Consistent with these predictions, empirical studies by Ferede (2017) and Cyrenne and Pandey (2015) found that recipient provinces impose higher business taxes and spend less on infrastructure than non-recipient provinces.

Turning to the results for the four largest provinces where we can calculate the MCFs for the corporate income taxes, the MCFs in Quebec and Alberta are 3.46 and 3.39 respectively and higher than these provinces' MCFs for their personal income taxes. That situation is reversed in Ontario and British Columbia where the MCFs for the personal income taxes (PIT) exceed those for the corporate income taxes. The MCFs for the provincial sales tax (PST), which ranged from 1.41 for Manitoba to 2.44 for Prince Edward Island, were lower than the MCFs for the CIT and PIT in each province. The large gaps between the MCFs for the CITs and the PSTs indicate that there would have been significant

---

11 The semi-elasticities indicate the long-run percentage reduction in the tax base in response to a one-percentage-point increase in the tax rate.

12 On the interpretation and measurement of the marginal cost of public funds as a measure of the marginal efficiency losses caused by taxation, see Dahlby (2008).

13 While Newfoundland and Labrador and Saskatchewan have not received equalization grants in recent years because they have received substantial resource royalty revenues, Newfoundland and Labrador received equalization grants until 2007-2008 and Saskatchewan received equalization every year from 1986-1987 to 2007-2008 except for 2003-2004.

welfare gains from reductions in provincial corporate income tax rates offset by increases in provincial sales taxes.[14]

TABLE 1 THE MARGINAL COST OF PUBLIC FUNDS FOR MAJOR PROVINCIAL INCOME TAXES IN 2018

	Marginal Cost of Public Funds		
	Corporate Income Tax	Provincial Income Tax	Provincial Sales Tax
Newfoundland and Labrador	***	3.81	1.82
Prince Edward Island	***	2.80	2.44
Nova Scotia	***	---	1.62
New Brunswick	***	2.51	1.59
Quebec	3.46	3.06	1.92
Ontario	2.62	6.76	---
Manitoba	***	2.42	1.41
Saskatchewan	***	2.27	1.53
Alberta	3.39	1.77	###
British Columbia	2.19	3.88	---

Notes: Calculations based on 2018 tax rates, average revenue shares 1972-2013, and estimates of the semi-elasticities of the tax bases based on data from 1972 to 2013 in B. Dahlby and E. Ferede, "The Marginal Cost of Public Funds and the Laffer Curve: Evidence from the Canadian Provinces," *FinanzArchiv*, vol.74, no.1, 2018.

*** indicates that a tax rate increase would reduce long-run total tax revenues.

--- indicates that the MCF could not be computed because the tax rates were stationary and the semi-elasticities could not be estimated.

the MCF for Alberta was not calculated because the province does not levy a sales tax.

To what extent is the tax sensitivity of the provincial CIT base the result of changes in real investment decisions or simply the shifting of taxable income across provincial boundaries by corporate groups with operations in more than one province wishing to take advantage of differences in provincial tax rates? Mintz and Smart (2004) developed a theoretical model of optimal borrowing and investment decisions for a corporation that operates as an independent corporation in multiple provinces. The optimal rule for debt placement is to borrow the maximum amount of deductible interest in every province with a statutory tax rate above the minimum for all provinces.

Mintz and Smart estimated the tax sensitivity of provincial taxable income based on data for 1986-1999 and found that the taxable income of large corporations that pay tax in a single province and are subsidiaries of other corporations was more responsive to tax rates than other large firms that allocate income between provinces according to the allocation formula. A Department of Finance Canada (2015) study extended the Mintz and Smart analysis by estimating an econometric model of the sensitivity of the taxable income to provincial CIT rates for two groups of corporations which they classify as "potential shifters" and "non-shifters". In general, the results of the Department of Finance study were

[14] See Dahlby (2012) for an analysis of the welfare gain from lowering corporate income taxes and introducing an HST in Alberta.

broadly consistent with the Mintz and Smart results and indicated a high potential for tax base shifting, although the study qualifies this conclusion by noting that the corporations with the highest elasticities represent only 22 per cent of the total CIT base.

4. EMPIRICAL RESULTS AND DISCUSSION

4.1 SPECIFICATION

Although dynamic panel fixed-effect estimation approach is common in the literature, it implicitly assumes the homogeneity of regression estimates and restricts economies to have the same short-run dynamics as well as long-run equilibrium. In particular, one may find the implicit assumption in such an approach – that the provinces, with varied economic structure, would converge to their long-run equilibrium at the same rate – to be questionable. An alternative to this approach of restricting coefficients to be the same for all provinces is to estimate the effects of fiscal policy on economic growth for each province separately. This method, however, does not take advantage of the rich variations that panel data analysis provides. Consequently, Pesaran et al. (1999) propose a pooled mean group (PMG) estimator that is an intermediate between the above two alternative estimation methods. The PMG allows each province to have different short-run dynamics, but assumes that they will have the same long-run equilibrium. For this reason, PMG has recently become popular and some of the recent empirical studies such as Xing (2012), Ojede and Yamarik (2012), Gemmell et al. (2011, 2014) and others employ this method to analyze the effects of fiscal policies on economic growth.

As we indicated before, one important advantage of the PMG estimator is that it allows the constant-term and short-term effects to vary across provinces while the long-term effects remain the same for all the provinces. Although our main interest is in investigating the long-term economic growth effects of tax rate changes, due to variations in the structure of their respective economies we expect the provinces to adjust to their long-term equilibrium differently. It is reasonable to expect similar provincial responses in the long term as they are subject to significant labour and capital mobility and operate within similar legal, monetary and regulatory frameworks. In the short run, on the other hand, due to the unique features of each province, they may tend to adjust to economic shocks and policy changes differently. Thus, our analysis is based on an error correction model specified as:[15]

$$\Delta lnY_{it} = \alpha_{Y,i}(lnY_{it-1}) + \alpha_{CIT}(lnCIT_{it}) + \sum_{j=0}^{n} \theta_{1i}\Delta lnCIT_{it-j} + \mu_i + \varepsilon_{it} \quad (1)$$

where Y_{it} is the real GDP per person in province i in year t. CIT is the corporate income tax rate in province i in year t. In Eq. (1) above, μ_i is the province-specific constant term and ε_{it} is the error term. Note that the dependent variable is the growth rate of real GDP per capita. In the above specification, only the key variables of interest are shown. However, the model incorporates various control variables that are generally deemed important in explaining economic growth. These other control variables are not shown, for brevity. In Eq. (1), the

[15] For the theoretical foundation of the empirical model, see Ferede and Dahlby (2012) and the references contained therein.

coefficient of the error correction term (a_{Yi}) is expected to be negative and allowed to vary across provinces so that each province will have its own adjustment path to the common long-term equilibrium. In Eq. (1), the long-term effects of the tax rate on economic growth are given by a_{CIT}. This coefficient is the same for all provinces and, as is common in the related literature, a_{CIT} can be interpreted as the percentage change in the annual growth rate associated with a one-per-cent change in the CIT rate. The dynamics of adjustment to long-run equilibrium vary by province and are given by (a_{Yi}). If the variables of interest are non-stationary, they will enter the error correction term expression in levels and the short-run dynamics in first-differences. Stationary variables will enter only in the short-run dynamics.

The PMG requires long panel data. With 35 years of annual provincial panel data, PMG is suitable for our empirical analysis. Note also that, as discussed in Pesaran and Shin (1999) and Pesaran (2015), the PMG estimator effectively deals with the potential problem of the endogeneity and autocorrelation problems and this avoids the need to find instruments for endogenous explanatory variables. In an attempt to highlight the channels through which taxes affect economic growth, Ferede and Dahlby (2012) included private investment in the growth regression and provided a separate estimate of the effect of tax rates on investment. In this paper, however, we do not control for private investment in our regression and hence the growth regression can be considered a reduced form that encompasses the effects of taxes on growth through both the level of investment and productivity. Such an empirical specification is common in the empirical literature. See, for instance, Lee and Gordon (2005).

Although this paper focuses on the CIT rate, the empirical analysis also controls for personal income tax, provincial sales tax, and the share of other own-source revenue in total revenue as additional explanatory variables. In addition to the tax rates, we also include additional control variables which were deemed to have effects on economic growth in previous studies. These control variables are the government expenditure to GDP ratio, public investment to GDP ratio, the provinces' main export commodity price index and U.S. real GDP. All variables enter in the regression in natural log form. Since Alberta does not impose a provincial sales tax, we use the log of one plus the sales tax rate in the regression.

4.2 DATA

In our empirical analysis, we use annual data for all 10 provinces for the period 1981-2016. We obtained the data on tax rates from Finances of the Nation and the Canada Revenue Agency. In addition, the key macroeconomic variables of GDP, government expenditure, public investment, population, exports and imports come from Statistics Canada data source CANSIM. We provide the basic summary statistics for the relevant variables in Table A1 in the appendix.

It should be noted that Statistics Canada has revised the Canadian GDP figures and consistent provincial data are available only from 1981 onwards.[16] Thus, direct comparison between the pre-and post-1981 GDP data series is impossible. This also makes replicating the results of Ferede and Dahlby (2012) and simply extending their data series infeasible.

[16] See Statistics Canada CANSIM Table: 36-10-0222-01 (formerly CANSIM 384-0038).

Consequently, we limit our analysis to the period 1981-2016. Thus, this paper focuses on investigating the relationship between corporate income tax rate and economic growth by employing a different data set, different time period and alternative empirical methodology than those used in Ferede and Dahlby (2012). This will help shed light if the previously obtained adverse effects of the corporate income tax rate on economic growth are robust to alternative data set, time period and empirical methodology.

4.3 ECONOMETRIC RESULTS

As discussed above, our empirical strategy enables us to estimate the long-run relationship between tax rates and economic growth by allowing their short-run dynamics to vary across provinces. This methodology requires a long time series that will be sufficient to estimate the short-run dynamics for each province separately. However, in studies that use long time series data such as ours, one needs to first investigate the time-series properties of the various variables of interest. The reason is that the PMG method assumes that the variables in the long-run relationship are non-stationary. For this reason, the first step in time-series analysis is to check for the order of integration of the various variables, and this is how we begin our analysis.

The results of the unit root tests reported in Table A2 in the appendix show that all the variables with the exception of population growth rate, PIT rate and PST rate are non-stationary in levels but they are stationary in first-differences, suggesting that they have possible long-term effects on growth and can enter the co-integrating vector.[17] The unit root tests, on the other hand, show that population growth, the PIT and PST rates are stationary in levels. Thus, these variables will be excluded from the long-term relationship that requires non-stationarity but will be included as part of the short-run dynamics of the model. Thus, it should be noted from the outset that due to the stationarity of PIT and PST rates, our analysis focuses on the long-term growth rate effects of the CIT rate rather than the other tax rates.

Table 2 below reports the long-run coefficient estimates of the various variables of interest obtained from the PMG estimator. The short-run coefficient estimates that vary across provinces are not shown, as our focus is on the long-term relationship between tax rates and economic growth. The dependent variable is the growth rate of real per capita GDP and the explanatory variables all enter in log forms. Although our empirical approach provides a separate convergence effect (i.e., coefficient for the lagged real per capita GDP) for each province, we present the mean convergence effect for all provinces to make a comparison possible with those studies that employ a different empirical approach. Generally, PMG estimation provides higher convergence coefficient than the dynamic panel fixed-effects estimation method such as those used in Ferede and Dahlby (2016). This is because the latter tend to underestimate such a coefficient due to its inherent downward bias.

---

[17] Statistically speaking, a variable is said to be stationary if its probability distribution (for example, its mean and variance) remains constant over time. However, if the variable's mean and variance change over time, it is considered non-stationary. Those variables which are non-stationary in levels but become stationary in their first- differences are said to be integrated of order 1, or I(1).

We begin our analysis in column (1) with the estimation of the long-run growth rate effects of CIT rate by controlling for government expenditures and public investment. The results suggest, as expected, that the CIT rate has a statistically significant negative long-term effect on the economic growth rate. As explained before, the empirical methodology allows the error correction term to vary by province. Thus, the reported convergence rate is the mean of the error correction terms for all the provinces. Note also that the coefficient of the error correction term (or the convergence effect) is, as expected, negative and statistically significant. The statistical significance of the convergence effect confirms that the growth rate and the fiscal variables are co-integrated or have a stable long-term relationship. This supports the choice of PMG as an appropriate method to investigate the long-term effects of CIT rate on growth.[18]

All Canadian provinces are small, open economies that are influenced by global economic and non-economic events. In particular, Canadian economic performance is highly dependent on the U.S. economy, as this country is its neighbour and largest trading partner. Furthermore, fluctuations in global prices of the Canadian provinces' main export commodities can affect economic growth and business activities in the provinces. For instance, the overall economic activity in Alberta greatly depends on global energy prices. Consequently, in column (2), we include the log of the commodity price index of the main export item of provinces (CommodityPrice) and the U.S. real GDP as additional control variables. The commodity price index is deflated by the GDP deflator to take into account the effect of inflation. The regression results reported in column (2) show that, as expected, global commodity prices and the U.S. real GDP have statistically significant positive effects on the growth rate. More importantly, the coefficient estimate of CIT, our key variable of interest, continues to be negative and statistically significant, suggesting its strong long-term effects on real GDP growth rate.

[18] Another common way to confirm the appropriateness of the use of PMG is to compare these estimates with those obtained from the mean group estimator (MG). The MG estimator estimates both the short-run and long-run growth rate effects of the variables for each province separately and uses the averages of these coefficients as the total estimate. While both PMG and MG allow the short-run dynamics to vary across provinces, the former constrains the long-run coefficients to be the same for all provinces. Peseran et al. (1999) show that this is consistent and a much superior method. In the literature, the Hausman test is used to test between these two models. In our case, the Hausman test statistic is not rejected at the conventional five-per-cent level and we do not reject the null hypothesis that PMG is efficient and preferred to MG. For this and other reasons discussed in the previous section, our empirical analysis is conducted with PMG.

TABLE 2 CORPORATE INCOME TAX RATE AND ECONOMIC GROWTH, 1981-2016

	(1) PMG	(2) PMG	(3) PMG	(4) PMG	(5) PMG	(6) IV
Long-run Coefficients						
Ln (CIT)	-0.498**	-0.087**	-0.095*	-0.050***	-0.045***	-0.076**
	(0.201)	(0.040)	(0.049)	(0.012)	(0.015)	(0.038)
Ln (GovGDP)	-0.438	-0.102	-0.119	-0.386***	-0.401***	-0.153***
	(0.280)	(0.085)	(0.097)	(0.061)	(0.064)	(0.032)
Ln (PubInvGDP)	-0.415***	0.065	0.082	0.157***	0.158***	-0.015
	(0.131)	(0.047)	(0.068)	(0.029)	(0.029)	(0.014)
Ln (CommodityPrice)		0.093***	0.099***	0.033**	0.032**	-0.001
		(0.022)	(0.028)	(0.013)	(0.013)	(0.006)
Ln (U.S. GDP)		0.547***	0.592***	0.210***	0.209***	0.032**
		(0.026)	(0.147)	(0.033)	(0.033)	(0.014)
Ln (OtherOwn)				-0.072**	-0.070**	0.038***
				(0.029)	(0.029)	(0.011)
RST dummy					-0.006	-0.002
					(0.012)	(0.008)
(*Mean*) Convergence rate	-0.059***	-0.128***	-0.120***	-0.255***	-0.253***	-0.301***
	(0.010)	(0.035)	(0.032)	(0.064)	(0.063)	(0.050)
Observations	340	340	340	340	340	340
Trend	No	No	Yes	Yes	Yes	Yes
PIT and PST included	No	No	No	Yes	Yes	Yes

Note: Pooled mean group (PMG) estimation method results. Dependent variable is the growth rate of real GDP per capita. Significance levels are shown by * for 10 per cent, ** for five per cent and *** for one per cent. The short-run dynamics are not reported. In the above table, the "(mean) convergence rate" is the average convergence rate estimate for all 10 provinces. The convergence rate for Alberta, corresponding to column (5) is -0.158 and it is statistically significant at the one-per-cent level since its standard error is 0.045. In column (6), the CIT rate is instrumented with current and one-period lagged values of weighted average (weighted by the inverse of the distance between major population centres) CIT rates of other provinces. We also use one-period lagged real per capita deficit as an additional instrument. The lagged dependent variable is also instrumented with its own lagged value.

Although our empirical approach includes province-specific constant terms to capture province fixed effects, there may still be some time-dependent important determinants of economic growth that our model excludes. To circumvent this problem, in column (3)

we include a time trend.[19] The time trend helps us capture the effects of those exogenous time-dependent factors excluded from the model, but which can influence the provincial economic growth rate. [20] The coefficient of the time trend is positive and statistically significant, suggesting the importance of accounting for those excluded time-dependent factors. More importantly, the coefficient of the CIT rate is still negative and statistically significant, but the coefficient estimate is slightly higher in absolute value.

So far, our analysis excludes PIT and PST rates as these variables are stationary and it is not feasible to include them in the long-run relationship. However, given the importance of these variables for provincial governments and the possible relationship between various tax rates, it would be possible to account for these tax rates in the short dynamics of the growth regression. For this reason, we include the PIT and PST rates in column (4). Further, to account for the government's budget constraint, we include the share of other own-source revenue in total government revenue as an additional explanatory variable. This enables us to interpret the tax rate coefficient of CIT as the effect of deficit-financed tax rate change on the provincial economic growth rate.

Finally, previous studies such as Ferede and Dahlby (2012) and others show that provincial retail sales taxes (RST) affect investment adversely as compared to those provinces that have harmonized their sales tax rate with the federal value-added tax, the GST. Thus, we include a dummy variable, *RST dummy*, to capture this potential differential effect of the two types of sales taxes in column (5). As column (5) includes all the relevant variables, this is our preferred regression result and we focus our discussion on the coefficient estimates of column (5).

Column (5) shows that the CIT rate has negative and statistically significant effects on the real per capita GDP growth rate. Also, note that the coefficient of mean convergence is negative and statistically significant, indicating that the economies will converge to their long-run equilibrium. Thus, the empirical model is consistent with the neo-classical growth model and tax rate changes have temporary effects on the economic growth rate. As indicated before, the empirical methodology allows each province to converge to the long-run equilibrium at its own convergence rate. Since we control for the various components of the government budget constraint, the coefficient estimates indicate that a one-percentage-point deficit-financed reduction in the CIT rate is associated with an increase in the growth rate of real per capita GDP by 0.12 percentage points four years after the initial CIT rate cut. Real per capita GDP would increase by 1.2 per cent in the long run. These results are based on the average convergence rate for the provinces, which implies that two-thirds of the adjustment to the new long-run equilibrium occurs four years after the tax cut and 95 per cent of the adjustment occurs after 10 years.

---

[19] The time trend will help us capture time effects. Including year dummies in the empirical model is an alternative way to capture time effects. Ideally, we would have liked to include year fixed effects in the growth regression. However, in the PMG model that relies on long panel, including many year dummies in the regression as additional explanatory variables is not feasible. This is a common challenge in all empirical studies that employ PMG. Nevertheless, in our sensitivity analysis we include five-year period dummies following previous studies such as Gemmell et al. (2014), Bassanini and Scarpetta (2002) and others.

[20] Some of such variables may include, for instance, monetary policy (e.g., interest rate) and other federal fiscal policies.

Regarding the other control variables, our preferred result shows that as expected, an increase in the government's current expenditure and public investment is associated with lower and higher economic growth rates, respectively. Thus, the results imply that while deficit-financed increases in non-productive government consumption expenditure affect growth adversely, increases in productive public investment, such as spending on infrastructure, are growth-enhancing. The other own-source revenue is also found to have a statistically significant effect on growth rate. These results are broadly consistent with the findings of previous empirical studies such as Gemmell et al. (2011, 2014) Further, an increase in global price of the provincial economies' major export commodities raises economic activities and increases economic growth rates. Thus, as expected, we find that the coefficient of the log of commodity prices is positive and statistically significant, suggesting that increases in the global prices of major exports are favourable to economic growth. Similarly, we find that an increase in the U.S. economy positively influences Canadian economic growth rate. This is not surprising given the strong dependence of the Canadian economy on the U.S. economy, as the two are major trading partners and their economies are highly interrelated.

Governments may use tax policy as a powerful tool to influence economic activities. For instance, governments may lower the CIT rate during economic downturns. If this is the case, the CIT rate may be endogenous. Furthermore, since our empirical model is dynamic panel, the presence of the lagged dependent variable as an explanatory variable makes it also endogenous. One may be concerned that such endogeneity of the CIT rate and the lagged dependent variable may bias coefficient estimates if it is not addressed properly. However, the PMG estimator is designed to be used in a dynamic panel model such as ours and effectively deals with the endogeneity of the lagged dependent variable by incorporating multiple lagged values of the change in the lagged dependent variable. As Pesaran (1997) discusses in detail, asymptotic or long-run inferences can be made on the short-run and long-run coefficient estimates from PMG even when the explanatory variables are endogenous. Thus, we believe relying on PMG estimates for long-term policy analysis despite the possible endogeneity of the CIT rate is appropriate. Nevertheless, as an additional robustness check, we expanded our estimation to include the commonly used instrumental variable (IV) estimation method in column (6).

In column (6), we estimate our dynamic panel model using IV method. Finding appropriate instruments is a common empirical challenge in employing IV method. As in Lee and Gordon (2005), Ferede and Dahlby (2012) and others, we treat the CIT rate as endogenous and instrumented it with contemporaneous and lagged values of the weighted-average (weighed by the inverse of the distance between major population centres) CIT rate of other provinces. The lagged per capita GDP is also treated as endogenous using its own period lagged values. Various statistical tests confirm the appropriateness of the instruments. The results of column (6) suggest that the CIT rate has a statistically significant effect on growth, but the coefficient estimate is higher in absolute value than our preferred result of column (5).

How do our preferred results compare to those of previous studies? Often, direct comparison may not be possible due to differences in methodology and specification. However, our results are broadly consistent with those of previous studies. Using the

dynamic panel fixed-estimation method, Ferede and Dahlby (2012) find that a one-percentage-point increase in the CIT rate is associated with a 0.184-percentage-point decrease in the real per capita GDP growth rate. This was the direct effect of the CIT rate on growth. They also find that CIT affects growth rate through investment. When the two effects are combined, their results suggest that a one-percentage-point reduction in the CIT rate is associated with about a 0.25-percentage-point increase in the growth rate. Thus, our preferred result is slightly higher than those of Ferede and Dahlby (2012).[21] Our coefficient of convergence is also higher in absolute value, suggesting that the provinces achieve their long-run equilibrium relatively more quickly and the effects of tax rate changes on growth will be spread over a relatively shorter time span than in Ferede and Dahlby (2012). This is generally expected since dynamic panel fixed-effects methods are known to yield downward biased convergence coefficients.

4.4 SENSITIVITY ANALYSIS

Arguably, one of the most important findings of previous theoretical and empirical studies is that many factors can influence the long-term growth rate of economies. However, studies often focus on some of the key variables of interest and we follow that common practice in our main analysis. In this section, we subject our main regression result to various robustness checks. In particular, we check the sensitivity of our result to the inclusion of additional control variables in the model. The results of the robustness checks are shown in Table 3 below.

Our main empirical analysis attempts to capture time effects by including time trends in the model. Ideally, we would like to include year fixed effects in the analysis. However, in the PMG model it is not feasible to include time dummies. This is generally true in all empirical studies that rely on a PMG estimator. Following previous studies such as such as Gemmell et al. (2014), Bassanini and Scarpetta (2002) and others, we check the robustness of our results to the inclusion of five-year time dummies in column (1). This allows us to capture province-specific non-linear trends in the model. The results show that the CIT rate still has a statistically significant effect on growth.

Previous studies such as Ferede and Dahlby (2012) find that the provincial government budget deficit to GDP ratio and population growth rate have significant effects on economic growth rate. We do not include these two variables in our main analysis due to the fact that they are stationary in levels. However, to check the robustness of our key finding, we include the deficit to GDP ratio in column (2) and the population growth rate in column (3) as additional control variables in the short-run dynamics of the empirical model. The results reported in columns (2) and (3) show that our key finding that CIT has a statistically negative effect on economic growth rate still holds. The short-run coefficient of the deficit to GDP ratio in column (2) and the coefficient of the population growth in column (3) are both negative as expected, but they are statistically insignificant.

---

[21] While Ferede and Dahlby (2012) estimate the growth rate on the CIT rate, this paper uses the log of the CIT rate. To make the results comparable, using the period average CIT rate of 0.14, we can transform the coefficient of this study as -0.045/0.14 = -0.32. This is slightly higher, in absolute value, than the estimate obtained in Ferede and Dahlby (2012).

Our empirical analysis is based on interprovincial variations in the CIT rate and its effects on economic growth rate. For this reason, the main empirical model does not include the federal government's CIT rate. We check the sensitivity of our main result by including the federal CIT rate in column (4) of Table 3. Since the time trend variable and the federal CIT rate are highly correlated, we drop the trend variable to include the federal CIT rate.[22] The results show that the coefficient of the provincial CIT rate remains negative and statistically significant, implying the robustness of the results. As expected, the coefficient of the federal CIT rate is also negative and statistically significant at the five-per-cent level.

As indicated before, we attempt to capture the effects of global shocks by including the commodity price index of each province's major export item. However, one may be concerned that just using a single sector or a single major commodity may not sufficiently capture the effects of global shocks. To address this concern, we use total export price index instead of commodity price index as a control variable in column (5). Again, the results are similar to our preferred estimates, suggesting the robustness of our results to the inclusion of additional control variables.

[22] The correlation coefficient between the two is about 97 per cent.

TABLE 3 ROBUSTNESS CHECKS, 1981-2016

	(1) Including year effects	(2) Including deficit ratio	(3) Including population growth	(4) Including federal CIT rate	(5) Including total export price growth
Ln (CIT)	-0.080*	-0.054***	-0.067***	-0.050**	-0.064***
	(0.047)	(0.014)	(0.017)	(0.020)	(0.019)
Ln (GovGDP)	-0.219***	-0.473***	-0.126	-0.356***	-0.333***
	(0.056)	(0.083)	(0.080)	(0.093)	(0.079)
Ln (PubInvGDP)	0.158***	0.115***	0.083**	0.133***	0.163***
	(0.025)	(0.026)	(0.034)	(0.038)	(0.034)
Ln (CommodityPrice)	-0.020	0.066***	0.068***	0.085***	
	(0.021)	(0.016)	(0.015)	(0.019)	
Ln (US GDP)	0.145***	0.255***	0.314***	0.383***	0.210***
	(0.024)	(0.038)	(0.046)	(0.034)	(0.036)
Ln (OtherOwn)	-0.171***	-0.085***	-0.176***	-0.126***	-0.129***
	(0.031)	(0.032)	(0.040)	(0.042)	(0.033)
RST dummy	0.003	0.002	0.026*	-0.005	0.003
	(0.006)	(0.014)	(0.014)	(0.017)	(0.012)
Ln (CITfed)				-0.095***	
				(0.035)	
Ln (ExportPrice)					-0.095
					(0.092)
(*Mean*) Convergence rate	-0.359***	-0.241***	-0.205***	-0.201***	-0.246***
	(0.069)	(0.069)	(0.056)	(0.048)	(0.053)
Constant	3.558***	1.687***	1.286***	1.242***	2.060***
	(0.699)	(0.479)	(0.395)	(0.283)	(0.435)
Observations	340	340	340	340	340
Trend	Yes	Yes	Yes	No	Yes
PIT and PST included	Yes	Yes	Yes	Yes	Yes

Note: Dependent variable is the growth rate of real GDP per capita. Significance levels are shown by * for 10 per cent, ** for five per cent and *** for one per cent. In column (1) province-specific five-year time dummies (i.e., dummies for the periods 1987-1991, 1992-1996, 1997-2001, 2002-2006, 2007-2011 and 2012-2016) are included instead of time trend. The short-run dynamics are not reported. The coefficient of deficit to GDP ratio in column (2) and the coefficient of population growth rate in column (3) are negative and statistically insignificant.

5. CONCLUSIONS

This paper provides an empirical estimation of the effects of provincial corporate tax rates on economic growth using annual panel data from Canadian provinces over the period 1981-2016. Our results are consistent with the empirical estimates of Ferede and Dahlby (2012), who used a different econometric methodology and sample period. We find that a reduction in the provincial CIT rate has a statistically significant positive effect on economic growth rate. Based on our preferred specification of the econometric model, a one-percentage-point reduction in a provincial government's statutory CIT rate increases the growth rate by 0.12 percentage points four years after the initial CIT rate cut and increases real per capita GDP by 1.2 per cent in the long run. The results are robust to various sensitivity checks.

REFERENCES

Arnold, J.M., B. Brys, C.J. Heady, A. Johansson, C. Schwellnus, and L. Vartia. 2011. "Tax Policy for Economic Recovery and Growth." *Economic Journal*, 121, 59-80.

Baiardi, D., P. Profeta, R. Puglisi et al. 2019. "Tax Policy and Economic Growth: Does it Really Matter?" *International Tax and Public Finance* 26: 282. Available at https://doi.org/10.1007/s10797-018-9494-3

Bassanini, A., and S. Scarpetta. 2002. "Does Human Capital Matter for Growth in OECD Countries? A Pooled Mean-Group Approach," *Economics Letters*, 74, 399-405.

Beaulieu, E., K. McKenzie, and J.-F. Wen. 2006. "Factor Taxes and Business Location." Working Paper. Department of Economics. University of Calgary.

Bleaney, Michael, Norman Gemmell, and Richard Kneller. 2001. "Testing the Endogenous Growth Model: Public Expenditure, Taxation and Growth over the Long Run." *Canadian Journal of Economics* 34(1), 36-57.

Clausing, K.A. 2014. "Lessons for International Tax Reform from the US State Experience under Formulary Apportionment." ICTD Research Report 2. U.K.: Institute of Development Studies.

Crisan, Daria, and Kenneth J. McKenzie. 2017. "Tax Subsidies for R&D in Canada, 1981-2016." *Canadian Tax Journal* 65(4): 951-81.

Cyrenne, Philippe, and Manish Pandey. 2015. "Fiscal Equalization, Government Expenditures and Endogenous Growth." *International Tax and Public Finance* 22: 311-329.

Dahlby, Bev. 2000. "Tax Coordination and Tax Externalities." *Canadian Tax Journal*, vol. 48. no. 2: 399-409.

———. 2002. "The Fiscal Incentive Effects of Equalization Grants" in *Equalization: Helping Hand or Welfare Trap.* Paper No. 4. Halifax: Atlantic Institute for Market Studies. April. (14 pages).

Dahlby, Bev, and Neil Warren. 2003. "The Fiscal Incentive Effects of the Australian Equalisation System." *Economic Record*, vol. 79, no. 247. December: 435-446.

Dahlby, B., and E. Ferede. 2012. "The Effects of Tax Rate Changes on Tax Bases and the Marginal Cost of Public Funds for Canadian Provincial Governments." *International Tax and Public Finance,* 19(16): 844-883.

———. 2018. "The Marginal Cost of Public Funds and the Laffer Curve: Evidence from the Canadian Provinces." *Public Finance Analysis (FinanzArchiv),* 74(2): 173-199.

Department of Finance Canada. 2015. "Interprovincial Tax Planning by Corporate Groups in Canada: A Review of the Evidence." *Tax Expenditures and Evaluations 2014*. Ottawa.

Djankov, Simeon, Tim Ganser, Caralee McLiesh, Rita Ramalho, and Andrei Shleifer. 2010. "The Effect of Corporate Taxes on Investment and Entrepreneurship." *American Economic Journal: Macroeconomics,* vol. 2, no. 3: 31-64.

Ebrahimi, P., and F. Vaillancourt. 2016. "The Effect of Corporate Income and Payroll Taxes on the Wages of Canadian Workers." Fraser Institute. Available at https://www.fraserinstitute.org/studies/the-effect-of-corporate-income-and-payroll-taxes-on-the-wages-of-canadian-workers

Fajgelbaum, Pablo D., Eduardo Morales, Juan Carlos Suárez Serrato, and Owen Zidar. 2019. "State Taxes and Spatial Misallocation." *The Review of Economic Studies* 86: 333-376.

Ferede, E., and B. Dahlby. 2012. "The Impact of Tax Cuts on Economic Growth: Evidence from the Canadian Provinces." *National Tax Journal*, 65(3), 563-594.

Ferede, E., B. Dahlby, and E. Adjei. 2015. "Determinants of Statutory Tax Rate Changes by the Canadian Provinces." *Economics of Governance* 16: 27-51.

Gale, W.G., A. Krupkin, and K. Reuben. 2015. "The Relationship Between Taxes and Growth at the State Level: New Evidence." *National Tax Journal* 68(4):919-942.

Gemmell, N., B. Kneller, and I. Sanz. 2011. "The Timing and Persistence of Fiscal Policy Impacts on Growth: Evidence from OECD Countries." *Economic Journal*, 121, 33-58.

———. 2014. "The Growth Effects of Tax Rates in the OECD." *Canadian Journal of Economics*, 47, 1217-1255.

Giroud, X., and J. Rauh. 2019. "State Taxation and Reallocation of Business Activity: Evidence from Establishment-Level Data." *Journal of Political Economy*. Forthcoming. doi:10.1086/701357

Hayashi, M., and R. Boadway. 2001. "An Empirical Analysis of Intergovernmental Tax Interaction: The Case of Business Income Taxes in Canada." *Canadian Journal of Economics* 34: 481-503.

Huang, Chye-Ching, and Nathaniel Frentz. 2014. "What Really is the Evidence on Taxes and Growth? A Reply to the Tax Foundation." Washington, DC: Center on Budget and Policy Priorities.

Johansson, Åssa, Christopher Heady, Jens Arnold, Bert Brys, and Laura Vartia. 2008. "Tax and Economic Growth." Economics Department Working Paper No. 620. OECD. Paris.

Karkalakos, S., and C. Kotsogiannis. 2007. "A Spatial Analysis of Provincial Corporate Income Tax Responses: Evidence from Canada." *Canadian Journal of Economics* 40(3): 782-811.

Kneller, Richard, Michael F. Bleaney, and Norman Gemmell. 1999. "Fiscal Policy and Growth: Evidence from OECD Countries." *Journal of Public Economics* 74(2), 171-190.

Koester, Reinhard B., and Roger C. Kormendi. 1989. "Taxation, Aggregate Activity, and Economic Growth: Cross-Country Evidence on Some Supply-Side Hypotheses." *Economic Inquiry* 27(3), 367-86.

Lattice Publishing. 2018. "States with the Highest (and Lowest) Homeownership Rates." June 19. Available at https://www.latticepublishing.com/blog/states-with-the-highest-homeownership-rates

Lee, Young, and Roger H. Gordon. 2005. "Tax Structure and Economic Growth." *Journal of Public Economics* 89(5-6), 1027-1043.

Ljungqvist, Alexander, and Michael Smolyansky. "To Cut or Not to Cut? On the Impact of Corporate Taxes on Employment and Income." Oct. 3. Available at SSRN: https://ssrn.com/abstract=2536677 or http://dx.doi.org/10.2139/ssrn.2536677

Mazerov, Michael. 2013. "Academic Research Lacks Consensus on the Impact of State Tax Cuts on Economic Growth: A Reply to the Tax Foundation." Washington, DC: Center on Budget and Policy Priorities.

McBride, William. 2012. "What is the Evidence on Taxes and Growth?" Tax Foundation. Special Report. No. 207.

McKenzie, K. 2016. "Inside the Black Box: Marginal Effective Tax Rates on Capital in Canada: A Primer." *Canadian Tax Journal* 64(4), 795-816.

McKenzie, K., and E. Ferede. 2017. "The Incidence of Corporate Income Tax on Wages: Evidence from Canadian Provinces." *SPP Technical Papers*, 10(7): 1-30.

McLure, Charles E. 1980. "The State Corporate Income Tax: Lambs in Wolves' Clothing," in Henry J. Aaron and Michael J. Boskin, eds., *The Economics of Taxatio*n. Washington, DC: Brookings Institution: 327-46.

———. 1981. "The Elusive Incidence of the Corporate Income Tax: The State Case." *Public Finance Quarterly* 9: 395-413.

Mertens, K., and M.O. Ravn. 2013. "The Dynamic Effects of Personal and Corporate Income Tax Changes in the United States." *American Economic Review*, 103 (4), 1212-1247.

Miller, S.M., and F.S. Russek. 1997. "Fiscal Structures and Economic Growth at the State and Local Level." *Public Finance Review* 25, 213-237.

Mintz, Jack, and Michael Smart. 2004. "Income Shifting, Investment, and Tax Competition: Theory and Evidence from Provincial Taxation in Canada." *Journal of Public Economics* 88: 1149-68.

Ojede, A., and S. Yamarik. 2012. "Tax Policy and State Economic Growth: The Long-Run and Short-Run of It." *Economic Letters*, 116, 161-165.

Parsons, Mark. 2008. "The Effect of Corporate Taxes on Canadian Investment: An Empirical Investigation." Working Paper 2008-01. Ottawa: Department of Finance.

Pesaran, M.H. 2015. *Time Series and Panel Data Econometrics*. New York: Oxford University Press.

Pesaran, M.H., Y. Shin, and R.P. Smith. 1999. "Pooled Mean Group Estimation of Dynamic Heterogeneous Panels." *Journal of the American Statistical Association* 94, 621-634.

Pesaran, M.H., and R.P. Smith. 1995. "Estimating Long-Run Relationships from Dynamic Heterogeneous Panels." *Journal of Econometrics* 68, 79-113.

Reed, W.R. 2008. "The Robust Relationship between Taxes and US State Income Growth." *National Tax Journal* 61, 57-80.

Smart, Michael. 1998. "Taxation and Deadweight Loss in a System of Intergovernmental Transfers." *Canadian Journal of Economics* 31, no. 1: 189-206.

Suárez Serrato, J.C., and O. Zidar. 2016. "Who Benefits from State Corporate Tax Cuts? A Local Labor Markets Approach with Hetergeneous Firms." *American Economic Review* 106: 2582-2624.

Xing, J. 2012. "Tax Structure and Growth: How Robust is the Empirical Evidence?" *Economics Letters*, 117, 379-382.

TABLE A1 PANEL UNIT-ROOT TESTS (1981-2016)

Variable	Variables in level		Variables in first-difference	
	IPS	Breitung	IPS	Breitung
ln (CIT)	-1.17	0.11	-13.83***	-3.83***
ln (PIT)	-4.47***	-1.94**		
ln (PST)[a]	-2.30***	-1.39*		
ln (GovGDP)	-1.62*	-0.001	-12.80***	-1.31*
ln (PubInvGDP)	0.05	-0.19	-12.22***	-3.24***
ln (CommodityPrice)	-0.74	0.37	-14.25***	--2.33***
ln(OtherOwn)	-6.18**	-1.01	-15.97***	-2.44***
ln(U.S. GDP)	-1.40*	-0.43	5.35***	-2.10**
Log (GDP per capita)	0.56	1.25	-11.86***	-1.77***

Lag selection based on AIC. Maximum lag is set at four based on the short data. All variables in levels except tax rates include trend. Significance levels are shown by * for 10 per cent, ** for five per cent and *** for one per cent.

[a] log of (1+PST).

TABLE A2 SUMMARY STATISTICS FOR KEY VARIABLES, 1981-2016

	Growth Rate				Ln (CIT)			
Province	Mean	Std.	Min.	Max.	Mean	Std.	Min.	Max.
Newfoundland and Labrador (NFL)	0.024	0.042	-0.111	0.113	-1.910	0.075	-1.966	-1.772
Prince Edward Island PEI)	0.018	0.021	-0.016	0.085	-1.918	0.162	-2.303	-1.833
Nova Scotia (NS)	0.015	0.020	-0.022	0.070	-1.847	0.027	-1.897	-1.833
New Brunswick (NB)	0.016	0.021	-0.025	0.084	-1.952	0.173	-2.303	-1.772
Quebec (QB)	0.012	0.019	-0.042	0.055	-2.449	0.262	-2.900	-2.129
Ontario (ON)	0.012	0.027	-0.047	0.071	-1.957	0.112	-2.163	-1.864
Manitoba (MB)	0.013	0.023	-0.042	0.068	-1.888	0.144	-2.120	-1.772
Saskatchewan (SK)	0.015	0.034	-0.051	0.092	-1.900	0.149	-2.120	-1.772
Alberta (AB)	0.012	0.036	-0.080	0.084	-2.081	0.180	-2.303	-1.864
British Columbia (BC)	0.011	0.027	-0.085	0.068	-1.985	0.183	-2.303	-1.802
All provinces	0.015	0.028	-0.111	0.113	-1.989	0.228	-2.900	-1.772

Note the figures are in decimals. For instance, the average growth rate for Alberta is 0.012 which is 1.2 per cent.

APPENDIX 1

In this appendix, we show how the estimated model can be used for policy simulation analysis. The main estimated empirical model of Eq. (1) can be rewritten as

$$\Delta lnY_{it} = \alpha_{Y,i}(lnY_{it-1}) + \alpha_{CIT}(lnCIT_{it}) + \sum_{j=0}^{n} \theta_{1i}\Delta lnCIT_{it-j} + \mu_i + \varepsilon_{it} \quad (1.1)$$

where Δ denotes change, ΔlnY_{it} is the growth rate in year t province i, Y_{it} is the real GDP per person in province i in year t. CIT is the corporate income tax rate in province i in year t. The other variables are as denoted before. As our focus is on the long-term relationship between the CIT rate and the growth rate, Eq. (1.1) can be rewritten as:

$$g_{it} = \Delta lnY_{it} = \alpha_{Y,i}(lnY_{it-1}) + \alpha_{CIT}(lnCIT_{it}) + Other\ terms \quad (1.2)$$

Alternatively, ignoring the *other terms*, Eq. (1.2) may be rewritten as:

$$lnY_{it} = \left(1 + \alpha_{Y,i}\right)(lnY_{it-1}) + \alpha_{CIT}(lnCIT_{it}) \quad (1.3)$$

Note that at the initial period, lnY_{it-1} is predetermined and hence $\Delta lnY_{it-1}=0$. Thus, from Eq. (1.3.), the impact of changes in the CIT rate is given by:

$$\Delta lnY_{it} = (\alpha_{CIT})\Delta lnCIT \quad (1.4)$$

From equation (1.3), the percentage gain in per capita GDP growth rate (Δg_{it}) due to a change in the CIT rate is given as:

$$\Delta g_{it} = (\alpha_{Y,i})\Delta \ln Y_{it-1} + (\alpha_{CIT})\Delta lnCIT \quad (1.5)$$

Taking Eq. (1.5) one period ahead, and using Eq. (1.4), the effect of CIT change one year after the CIT cut, the impact on growth rate is

$$\Delta g_{it+1} = (\alpha_{Y,i})\Delta \ln Y_{it} + (\alpha_{CIT})\Delta CIT = (1 + \alpha_{Y,i})(\alpha_{CIT})\Delta CIT \quad (1.6)$$

Similarly, for the second year, the impact on growth rate can be calculated as:

$$\Delta g_{it+2} = (\alpha_{Y,i})\Delta \ln y_{t+1} + (\alpha_{CIT})\Delta CIT = (1 + \alpha_{Y,i})^2(\alpha_{CIT})\Delta CIT \quad (1.7)$$

Thus, generalizing the above, the impact of a change in the statutory corporate income tax rate (CIT) on the growth rate j years after the tax cut, g_{t+j}, can be computed as:

$$\Delta g_{it+j} = \left(1 + \alpha_{Y,i}\right)^j [\alpha_{CIT}]\Delta CIT \quad (1.8)$$

We use the above equation to conduct simulation analysis and assess the effect of CIT rate change on the economic growth rate for Alberta.

About the Authors

Ergete Ferede is currently an associate professor of Economics at MacEwan University and a Research Fellow at The School of Public Policy. His BA and MSc are from Addis Ababa University in Ethiopia and his PhD is from the University of Alberta in 2005. His main research areas are public finance and economic growth. His research has been published in the *National Tax Journal*, *International Tax and Public Finance*, *Small Business Economics*, etc. He previously taught a wide range of courses at Addis Ababa University, the University of Alberta and the University of Windsor. He was a winner of the University of Windsor Teaching Score Award for the academic year 2005/6.

Bev Dahlby, Distinguished Fellow at the University of Calgary's School of Public Policy, attended St. Peter's College, the University of Saskatchewan, Queen's University and the London School of Economics. He is also the Research Director as well as the Director of the Tax and Economic Growth program at The School. Dr. Dahlby has published extensively on tax policy and fiscal federalism.

Dr. Dahlby has served as a policy advisor to the federal and provincial governments. He was a member of the Jenkins Panel on federal support for research and development. In 2016, Dr. Dahlby chaired the British Columbia Commission on Tax Competitiveness. In May 2019, he was appointed to the MacKinnon Panel to review the Government of Alberta's finances. His international experience includes advisory work on tax reform for the IMF in Malawi, for the Thailand Development Research Institute, and for the World Bank in Brazil and Mexico.

ABOUT THE SCHOOL OF PUBLIC POLICY

The School of Public Policy has become the flagship school of its kind in Canada by providing a practical, global and focused perspective on public policy analysis and practice in areas of energy and environmental policy, international policy and economic and social policy that is unique in Canada.

The mission of The School of Public Policy is to strengthen Canada's public service, institutions and economic performance for the betterment of our families, communities and country. We do this by:

- *Building capacity in Government* through the formal training of public servants in degree and non-degree programs, giving the people charged with making public policy work for Canada the hands-on expertise to represent our vital interests both here and abroad;
- *Improving Public Policy Discourse outside Government* through executive and strategic assessment programs, building a stronger understanding of what makes public policy work for those outside of the public sector and helps everyday Canadians make informed decisions on the politics that will shape their futures;
- *Providing a Global Perspective on Public Policy Research* through international collaborations, education, and community outreach programs, bringing global best practices to bear on Canadian public policy, resulting in decisions that benefit all people for the long term, not a few people for the short term.

The School of Public Policy relies on industry experts and practitioners, as well as academics, to conduct research in their areas of expertise. Using experts and practitioners is what makes our research especially relevant and applicable. Authors may produce research in an area which they have a personal or professional stake. That is why The School subjects all Research Papers to a double anonymous peer review. Then, once reviewers comments have been reflected, the work is reviewed again by one of our Scientific Directors to ensure the accuracy and validity of analysis and data.

The School of Public Policy
University of Calgary, Downtown Campus
906 8th Avenue S.W., 5th Floor
Calgary, Alberta T2P 1H9
Phone: 403 210 3802

DISTRIBUTION
Our publications are available online at www.policyschool.ca.

DISCLAIMER
The opinions expressed in these publications are the authors' alone and therefore do not necessarily reflect the opinions of the supporters, staff, or boards of The School of Public Policy.

ISSN
ISSN 2560-8312 The School of Public Policy Publications (Print)
ISSN 2560-8320 The School of Public Policy Publications (Online)

DATE OF ISSUE
September 2019

MEDIA INQUIRIES AND INFORMATION
For media inquiries, please contact Morten Paulsen at 403-220-2540. Our web site, www.policyschool.ca, contains more information about The School's events, publications, and staff.

DEVELOPMENT
For information about contributing to The School of Public Policy, please contact Catherine Scheers by telephone at 403-210-6213 or by e-mail at catherine.scheers@ucalgary.ca.

RECENT PUBLICATIONS BY THE SCHOOL OF PUBLIC POLICY

THE ROLE OF STORAGE IN ALBERTA'S ELECTRICITY MARKET: SUMMARY OF A SCHOOL OF PUBLIC POLICY ROUNDTABLE EVENT
https://www.policyschool.ca/wp-content/uploads/2019/09/AB-Electricity-Shaffer.pdf
Blake Shaffer | September 2019

NURTURING GLOBAL GROWTH COMPANIES: TIME FOR A NEW POLICY TOOLKIT
https://www.policyschool.ca/wp-content/uploads/2019/09/Global-Growth-Companies-Lortie.pdf
Pierre Lortie | September 2019

THE WESTERN ALLIANCE IN THE FACE OF THE RUSSIAN (DIS)INFORMATION MACHINE: WHERE DOES CANADA STAND?
https://www.policyschool.ca/wp-content/uploads/2019/09/Final-Version_Western-Alliance-Sukhankin.pdf
Sergey Sukhankin | September 2019

ALTERING THE TAX MIX IN ALBERTA
https://www.policyschool.ca/wp-content/uploads/2019/09/Tax-Mix-Alberta-McKenzie-final-version.pdf
Kenneth McKenzie | September 2019

SOCIAL POLICY TRENDS: CANADA AND U.S. FERTILITY RATES, 1920-2018
https://www.policyschool.ca/wp-content/uploads/2019/08/Social-Policy-Trends-Birth-Rates-August-2019.pdf
Ronald Kneebone | August 2019

SLOW, SUBJECTIVE AND STRESSFUL: A GUIDE TO CANADA'S ASYLUM SYSTEM
https://www.policyschool.ca/wp-content/uploads/2019/08/Asylum-System-Falconer-Final.pdf
Robert Falconer | August 2019

REGULATING FINTECH IN CANADA AND THE UNITED STATES: COMPARISON, CHALLENGES AND OPPORTUNITIES
https://www.policyschool.ca/wp-content/uploads/2019/08/Fintech-Clements-final.pdf
Ryan Clements | August 2019

UNDERSTANDING CONSULTATION AND ENGAGEMENT WITH INDIGENOUS PEOPLES IN RESOURCE DEVELOPMENT
https://www.policyschool.ca/wp-content/uploads/2019/07/Indigenous-Consultation-Boyd-Lorefice-final2.pdf
Brendan Boyd and Sophie Lorefice | August 2019

WHERE IN THE WORLD ARE CANADIAN OIL AND GAS COMPANIES? 2017
https://www.policyschool.ca/wp-content/uploads/2019/07/Where-in-the-World-2017-Larson.pdf
Braeden Larson | July 2019

TRADE POLICY TRENDS: BREXIT: IMPLICATIONS FOR CANADA-UK TRADE
https://www.policyschool.ca/wp-content/uploads/2019/07/Trade-Policy-Trends-Brexit-final.pdf
Dylan Klemen and Eugene Beaulieu | July 2019

SOCIAL POLICY TRENDS: FINANCIAL SUPPORT FOR REFUGEES AND ASYLUM SEEKERS
https://www.policyschool.ca/wp-content/uploads/2019/07/Financial-Supports-for-Refugees-and-Asylum-Seekers-FINAL-version.pdf
Robert Falconer | July 2019

ENERGY AND ENVIRONMENTAL POLICY TRENDS: OUR PLANET IN 2040: COMPARING WORLD ENERGY OUTLOOKS
https://www.policyschool.ca/wp-content/uploads/2019/07/Energy-Trends-World-Energy-Outlooks-final-2.pdf
G. Kent Fellows, Victoria Goodday, Rabia Ladha, and Jennifer Winter | July 2019

HISTORY OF DEVELOPMENTAL DISABILITY POLICY IN ALBERTA
https://www.policyschool.ca/wp-content/uploads/2019/07/History-of-Disability-Sonpal-Valias.pdf
Nilima Sonpal-Valias | July 2019